

Analysis and evaluation of defects in high-strength aluminum castings using X-ray computed tomography

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In response to the recent trend toward lighter transportation equipment, requests for the development of high-strength aluminum products that can replace stainless steel propeller products are increasing. Therefore, in order to produce high-quality, high-strength aluminum products while minimizing casting defects, systematic research and development is necessary, including optimization of the casting process and evaluation of product reliability. To manufacture high-strength aluminum propellers, we selected the 7xxx series alloy, which can replace the existing A356 aluminum alloy, and attempted to manufacture propeller products using a low-pressure die casting process. However, difficulties arose, such as the molten metal not being filled and hot cracks occurring. Process improvements were needed to resolve this issue. An alloy with low hot cracking sensitivity was selected, and the mold shape was improved in areas where defects frequently occur to produce a prototype. Afterwards, the condition of the prototype was evaluated using X-ray CT, and a process condition without defects was gradually found. Through this, it was experimentally verified that X-ray CT can be used as a very useful method for determining defects in aluminum castings. However, in order to apply it to actual process lines, the development of an improved X-ray CT system must proceed. In order to maintain an inspection speed that matches the process speed, inspection must be performed by designating the area requiring inspection, and standards for allowable defect sizes must also be established.